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NASA PRODUCT POSSIBILITIES AND PATENTS*

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You have heard from Mr. Gadberry a few of the advanced techniques that are being used to solve the fabrication problems of the space program. Inevitably there are product opportunities arising out of the new devices created to serve the space program. Let's explore a few of these product possibilities.

PRINTED CABLES

Here is a printed cable, developed extensively by Werhner Von Braun's team at Huntsville, to reduce the weight of cabling and improve the reliability of wiring. This flexible multiconductor cable weighs only 15 per cent as much as conventional wiring and can be cemented directly to the supporting structure. Because of its shape and good heat dissipation, it carries much more current than its conductor size might suggest.

Those of you driving a 1962 Buick are already beneficiaries of NASA's ingenuity! Here is the conventional dashboard wiring harness -- quite a service problem in the cramped space back of the dash. Here, however, is the 1962 dash panel utilizing printed cabling cemented onto the injection molded dash insert. The plastic case, together with the printed cable, makes both the lamp sockets and wiring. The cost of this assembly is about the same as that for the hand-made harness, but savings in assembly time and freedom from service within the

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warranty period makes Buick very happy indeed, to share in space technology. You can use printed cables to particular advantage wherever you must make lots of electrical connections: telephone switchboards, computer wiring, or electric organs. We suggest its use on outdoor advertising signs of the type that use hundreds of tiny flashing bulbs. Makers of athletic scoreboards could use it. What other uses of this ingenious development can you think of for your business?

MIXERS

There never was a mixing job quite as tricky as blending solid propellants. Just think of all the difficulties: the stuff to be mixed is viscous and gooey. The bearings in the mixing zone can contaminate the propellant with grease. Moreover, the possibility of crystals being trapped in the bearings poses a serious explosion hazard. A totally new type of mixer was devised for United Technology Corporation to turn out smooth blends of solid propellant more quickly and safely. This mixer has three planetary blades, providing close clearances and high shear in a change-can design. It works four times as fast as the regular pony mixer, and can mix either small or large batches in the same equipment. It is particularly good for flushed colors, caulking compounds, and plastic colorant masterbatching. You should consider this new design next time you buy a mixer, or perhaps you can adapt the basic idea to some type of mixer, muller or blender that you make.

FRANGIBLE TUBE ENERGY ABSORBER

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To absorb the shock of Space Capsules hitting the ground at a vertical velocity of 40 miles per hour, many energy dissipation schemes were studied.

This frangible metal tube system is the most efficient energy dissipater; it is simple, compact, reliable and gives uniform deceleration. This slide shows a fast action sequence, as an Apollo capsule hits the ground at 40 feet per second and is brought to a stop with only 7g acceleration -- about like falling out of bed. Perhaps this system would provide a "seat belt" on your whole automobile. It could take some of the crumple out of train wrecks, and it should be better than the emergency springs now found at the bottom of elevator shafts. How can you put this new concept to work for you?

A producer of helicopters in Wichita is investigating the frangible tube as emergency overload shocks on the landing gear. This type of energy absorber is especially needed if the engine stalls at altitudes of 25 to 100 feet, where the rotors don't have time to catch the air and lower the helicopter safely to the ground.

CHAIN RUBBER DRIVE

In NASA's engineering, just as in your own, unexpected discoveries sometimes result from improvising to stay within the budget.

Here is a view of a unique power transmission drive developed at Ames for use on their 5 degree-of-freedom centrifuge. For powerful precision motion control, they wanted a very costly gear drive. But they "made-do" with a sort of topsy-turvy drive -- steel timing chain running on a rubber faced sheave. To NASA's surprise and pleasure, this new type of drive is more powerful, quieter, and more positive than the most expensive herringbone gear drive.

If you need power and precision in your heavy duty machines, look into this low cost drive system. It's a natural for power shovels, cranes, hoists, horizontal milling machines and marine power.

STEREO VIEWER

An example of new training aids is this 3-D Stereo Viewer developed for pilot training. True stereovision is obtained on the viewing screen without the need for special glasses or other accessories. Opportunities to employ this principle in teaching, simulation or operator training are obvious. If the same functions can be built in simpler form, a tremendous market exists among amateur photographers.

DIGITAL SOLAR ASPECT SENSOR

This device, developed at the Goddard Space Flight Center for satellite use, measures the angle between the sensor and a point light source, then converts this angle to digital form. It is quite small, accurate and lightweight.

CIRCUIT BREAKER

This circuit breaker, developed for use in satellites, is small, lightweight and rugged. It will automatically reset itself. On circuit overload, the breaker absorbs the power in a heater until the circuit overload is cleared at which time the breaker automatically restores full power to the load.

Thus far we have been looking primarily at the space technology associated with launch vehicles, satellites, and instrumented probes. The program of manned space exploration also provides some spin-off ideas that have one special virtue: They are largely concerned with people!

Supporting a man in space effectively requires many items that can be used here on earth, and after all, there are 180 million potential customers in the United States for new types of clothing, better food, environmental control, safety equipment, sports equipment, medicine and communications.

HIP PACK

This hip pack is a by-product derived from the rocket units that will be used to maneuver on the moon. It places all the load on the pelvis and none on the spine. With this unit a man can pick up 600 pounds, walk with 300 pounds, or he can carry 100 pounds for a long time without fatigue. This is said to be the first real improvement in human load carrying since the Koreans invented "A" frames 2,000 years ago. Industrially these devices can find use in maintenance, civil defense and emergency operations.

LIFE RAFT

This is the non-tip life raft on which Scott Carpenter spent several anxious hours. Developed at The Manned Spacecraft Center in Houston, a man can stand on the edge of this raft and it will not tip. It consists of an inflated tube with a raft bottom and curtains made of aluminized mylar that are designed to keep out spray and splash. The buoyant tube, the raft bottom,

and the three stabilizing ballast buckets on the bottom of the raft are made of neoprene-coated fabric. The raft is significantly lighter than the military para-raft, packs to about 1/2 the thickness, and offers more occupant space. Surprisingly, the life raft has only one seam, and it is fabricated "on the flat". Thus, rafts of this design could be manufactured by almost any converter of coated fabrics; and one Kansas manufacturer has our life raft right now, planning to start making a similar unit.

FLOTATION PACK

While Carpenter and Schirra didn't have to use it, they carried this lightweight emergency flotation device designed to support a man wearing a water-filled space suit. The life vest is made of neoprene-coated nylon fabric. It is inflated by means of a carbon dioxide cartridge or by a mouth tube. The complete assembly is the size of two packs of cigarettes and weighs only one pound. The complete life jacket assembly has been opened, inflated and donned with one hand in less than ten seconds by a man encumbered by a space suit. This life vest should be of interest to the overseas airlines and to firms in the pleasure boating field.

These are a few examples of space developments and product items that are industrially useful. I hope that one or more of the examples I have cited matches your business needs, and are of interest to you. But the space program is so broad that in the months to come, ideas will be emerging that can be applied to your manufacturing.

When we start thinking in terms of manufacturing a new product, the question of patents always arises.

PATENTS

Any organization that is conducting research, exploring new fields, and pushing forward the frontiers of knowledge, will certainly give birth to a constant stream of ideas that are new, useful and patentable. This fact is true in history and is true now of NASA. In the short time since NASA was formed, it has obtained over 1,000 ideas for patent consideration. Some of these ideas are already patented and most of them are still pending.

We have heard in the previous talks an indication of the rate of increase of NASA's budget. The rate of increase of NASA invention disclosures follows a similar curve. There is a direct correlation between money fed into and inventions coming out of a scientific research organization. Next year NASA can expect patent applications at the approximate rate of one per day.

So we will have a better idea of what we have to work with, let's look into the case record files of NASA's Office of Patent Affairs. There we find four broad classifications of patents and patent applications.

First are the issued patents that are owned by the Government. This list of patents, for example, includes such items as:

1. High Temperature Nickel Base Alloy, that will operate at a stress level of 15,000 psi at 1800°F with no protective coating. This material was intended for jet engine blades, but may well be just the thing for high-temperature valves and piping.

2. Self-Supporting Space Vehicle (Echo Satellites). This patent has the obvious application of air-supported buildings, since the material is light, strong and flexible. Another less obvious application might be as an inflatable room inside existing factory buildings for clean rooms, odor control, or for contamination control.

3. Flexible Seal for Valves. This is an inflatable seal for butterfly valves that extends the range of these simple valves.

4. Folding Apparatus. This is a centrifugal folding apparatus used to fold the Echo Satellites into an unbelievably small package. It would be useful for very compact folding of any flexible sheet material.

The second general classification of patents is issued patents, inventor owned. These are patents obtained by NASA and relating to NASA's work, but waived to the inventor to achieve an "equitable situation" or to accelerate the application of the patent in industry. Waived patents carry the restriction that the inventor must use it or license others to use it in five years. If he does this, he gets permanent, irrevocable possession of the patent. If he fails to do this, he may lose his rights to the patent.

Scanning the list of inventor-owned patents, we find these examples:

1. A Spray Gun Nozzle -- for catalyzed plastic resin. This gun receives the plastic resin and the catalyst separately and mixes them in the nozzle, thereby eliminating the pot life problem in the use of sprayed plastic coatings.

2. A Fluid Flowmeter -- using heat transfer principles. This design may be useful for very large flow rates in large piping where conventional flowmeters are just not practical.

3. Band Pass Shock Absorber -- that is frequency sensitive. Almost any shock absorber will handle large amplitude, low frequency shocks, but when shocks occur at high frequency, they tend to become rigid links. This one continues to be an effective shock absorber at the high frequencies such as occur on aircraft landing gear or railroad cars at high speed.

4. A Liquid Aerosol Indicator -- that measures the suspension of a liquid in a gas.

5. Rocket Combustion Chamber.

Unless you happen to be in the rocket business, you have little use for a new design rocket combustion chamber. However, strain gauges and shock absorbers are widely used in industry.

The third category of patents and patent applications is inactivated applications.

A patent application is usually inactivated by NASA when there is no immediate application for the idea for space technology, or investigation showed the idea was really not patentable in the first place, usually because of prior art, prior patents, or prior publication. Just because an idea is not patentable, however, does not, by itself, mean the idea is not useful.

The list of inactivated applications contains such items as:

1. A manometer float and servo control system.
2. Noise suppressor for jet aircraft.
3. A color film process that was inactivated because of prior publication.
4. A mechanical system for cleaning cooling towers. This application was abandoned because of a lack of Government interest. This application was for a system for the automatic acid rinse and sump blowdown of cooling towers that uses no electric power. The pumps and controls are powered by water motors. This system may well prove valuable to people who must maintain atmospheric cooling towers in remote locations.

The fourth and largest group is the applications still pending. These are applications that have been filed and are being processed through the patent office by NASA's Office of Patent Affairs.

This group of patent applications includes many of the items you have already heard about today, such as the frangible tube, magnetic metal forming, and printed circuit connectors.

It also includes such items as:

1. Thin Wall Castings. This application is for an improvement in the technique of investment casting, commonly referred to as the lost wax process. This process substitutes hot stretch formed plastic for the wax. The result is the ability to produce very thin wall castings with extremely smooth surface finishes.

2. Liquid Level Sensors, for cryogenic liquids.
3. A new High Voltage Insulator.
4. A Crack Finder for control of automatic welders. This device sets up eddy currents in the pieces to be welded, then homes on the crack and guides the welding head accurately along the crack.
5. Tube Flaring Machine. This device provides a rolling contact between the flaring tool and the tube being flared. The result is a perfectly circular, smooth flare of uniform thickness.

Now, we have talked about four major classifications of patents and patent applications. A fifth classification would be those inventions that have been classified for security reasons. These represent a very small number of items and are of no interest to us on this program until such time as they may be declassified. None of the items discussed in this program are classified.

We have had a glimpse into the content of NASA's patent files. Where do we go from here? What does NASA intend to do with these inventions? And how does Midwest Research Institute's Project ASTRA fit into this patent picture?

It is NASA's clear intention to see that these inventions, resulting from their spending of your tax dollars, are put to good use, in the best public interest. For these particular inventions, now documented in NASA's Office of Patent Affairs, your money has already been spent, and we taxpayers have gotten our money's worth in terms of advancement of the space program. To find useful industrial applications of these inventions, then, gives us taxpayers a double return on our investment.

This is where MRI's Project ASTRA comes in. Project ASTRA is, in part, an instrument through which the NASA Patent Office can further serve the public interest.

Specifically we will do two things:

First, we will continue to search the NASA patent files, looking for ideas that appear to have possible application in the fields in which you tell us you are interested. We will publicize our findings in meetings like this one and in regular mailing letters.

Second, we will act as a point of clearance between you, a potential patent user, and NASA's Office of Patent Affairs. If you express an interest in an item you have seen or heard about today, we will determine for you what the patent status is -- if it is patented, who owns the patent, and what licensing arrangements are available. Then we will work with you to determine what action is necessary to obtain a license.

I have not attempted to go into the details of licensing agreements and all the possible circumstances that can affect these negotiations. Suffice it to say that licensing arrangements can be obtained, and the most important consideration in these license negotiations will be the furthering of the public interest. For Government-owned patents, for example, a non-exclusive license will be made available with a minimum of formalities.

NASA patent policy is characterized by three distinct features:

1. It is in the law of the land.

2. No royalties will be charged by NASA for the practice of NASA inventions.

3. NASA patent policy is extremely liberal, being based on the general policy that "NASA inventions will best serve the interests of the United States when they are licensed and worked."

If you, or your company, are seriously interested in using, manufacturing, or marketing an item with a NASA patent history, and if it is clearly in the best public interest that you do so, then a way is open, or a way will be opened for you to use it.